REQ. NO. 23440-9180

CONTRACT REPORT NO. OSQ84-00235

INVESTIGATION OF ADAPTABILITY OF THE KNELSON CONCENTRATOR TO ORE BENEFICIATION

By

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MICROMEDIA

CONTENTS:

ABSTRACT

1. INTRODUCTION

2. DESCRIPTION OF THE TESTWORK

2.1. Testwork cn Forest Hill ore sample

2.1.1.Ore Sample

2.1.2.Equipment

3.1.3.Testwork conditions and Results

2.2. Testwork on Blackham Material

2.2.1. Feed Material

2.2.2. Equipment

2.2.3. Testwork conditions and Results

3. TECHNICAL DISCUSSION

4. CONSLUSIONS

ABSTRACT

In accordance with the contract between Lee-Mar Industries Ltd. and Supply and Services Canada, the agreed test work was performed on both the Forest Hills tailings and on the Blackham Gravel samples from Chilliwack, B.C. The result of same is that the Knelson Concentrator does in fact recover very fine gold but the gold in these materials are for the most part held in sulphides or rubbed onto particles (smear gold) and as such are not amenable to the present batch type recovery. Therefore, it will not be a viable mining venture. However, the writer believes that the new Knelson Continuous Recovery Concentrator could in fact make the Forest Hills tailings a likely prospect for profitable recovery. The Blackham gravels are too low in value for the same consideration.

1. INTRODUCTION

An agreement was reached between Lee-Mar Industries and CANMET of E.M.R., Ottawa to evaluate the concentrating ability of the Knelson Concentrator.

The terms of the agreement were presented in the Contract 0SQ84-00235.

The program consisted of:

- Testwork using a 7.5" Knelson Concentrator to determine the possibility to upgrade a gold tailing sample from Nova Scotia.
- Demonstration test on Blackham placer gravel in Chilliwack, using a Knelson mobile unit to evaluate the performance of the equipment in commercial application.
- In this placer the equipment performance in a commercial application was evaluated.

2. DESCRIPTION OF THE TESTWORK

The testwork to investigate the adaptability of the Knelson Concentrator to ore beneficiation was carried out on two samples:

- Forest Hill gold tailing from Nova Scotia
- Blackham gold placer from Chilliwack

2.1. Testwork on Forest Hill Ore Sample

2.1.1. Ore Sample

The ore sample originated from an old gold tailing pond in Nova Scotia. Approximately 1 tonne of ore sample was obtained for this testwork.

The size distribution of the material, evaluated in CANMET Laboratories, indicated that about 16% of the ore reported in the -0.075mm (200 mesh) fraction and only 2.4% was retained on the 0.425mm (35 mesh) screen.

It was considered that the size distribution of the ore was suitable for concentration in the Knelson Concentrator.

The assay of the ore indicated a content of 1.7g/t au.

2.1.2. Equipment

The testwork was performed using a 7.5" Knelson Concentrator cone.

The equipment set-up is given in Fig.1.

Water was obtained from a pond and pumped to the cone unit to provide the feed slurry.

The ore was diluted with water and passed through a 6mm (¼") screen. The oversize was removed and the undersize was fed directly in the cone through the centre pipe.

A ½ h.p. motor is used to rotate the cone to 800 rpm.

The heavier particles are trapped by the ribs in the cone while the lighter material is carried over the rim of the cone. Compaction of the trapped material is prevented by enclosing the cone in a water jacket and injecting water through graduated perforations in the cone wall.

Collection of the concentrate is accomplished by flushing the cone with water at the end of the test.

The technical characteristics of this unit are:

Water pump: 1.5 inch
Cone
- Weight: 200 lbs
- Dimensions: 2x1.5x1.5
- Motor: ½ H.P., 800 rpm

Screen
- Dimensions: 3x4x2
- Opening: 3/16
- Motor: ½ h.p.

2.1.3. Testwork Conditions and Results

The ore sample was thoroughly mixed and a head sample was removed for assay.

Then, nine charges of approximately 23 kg (50 lbs) each were taken for testwork.

The testwork to evaluate the response of the ore to Knelson cone concentration was carried out in two series of tests.

In the first series of test eight experiments were performed to study the influence of the water backpressure on grade and gold recovery in the concentrate.

The second series of tests were carried out to evaluate the possibility of improving the gold recovery in the concentrate by reprocessing the tailing obtained in the previous stage of concentration.

These tests were performed at the optimum backpressure conditions (5psi) found in the previous tests.

The conditions and results of these experiments are presented below:

a) Tests to evaluate the influence of backpressure

Conditions

Feed rate (solids): approx. 500 kg/h
Water to the feed: approx. 32 l/min
Slurry feed density: approx. 20% solids
Backpressure water rates: 60 - 143 l/min.
Water Pressure: 4 - 18 P.S.I.

Results

The results of these tests are given in Table 1.

As can be seen from this table, the best results were achieved under Test #5 conditions where a backpressure of 5 psi was applied. A Concentrate of 8.3% weight yield was obtained at a content of 5.6 g/t for a recovery of 33.9% Au.

The increase in the backpressure reduced somewhat the amount of concentrate collected improving a little its grade, but the gold recovery dropped significantly.

Reducing the backpressure to 4 psi did not have any positive effect on the results.

TABLE I. Results of backpressure variation tests ($7\frac{1}{2}$" cone)

Forest Hill

Test No.	Feed Rate kg/h	Backpressure P.S.I.	Product	Weight g	Weight %	Assay Au g/t	% Dist Au	Units
6	681	4	Head	22,700.0	100.0	1.57	100.0	156.81
			Conc	1,766.9	7.8	6.121	30.4	47.74
			Tails	20,933.1	92.2	1.183	69.6	109.07
5	454	5	Head	22,700.0	100.0	1.38	100.0	137.98
			Conc	1,888.8	8.3	5.631	33.9	46.74
			Tails	20,811.2	91.7	0.995	66.1	91.24
4	454	6	Head	22,700.0	100.0	1.75	100.0	175.20
			Conc	1,854.6	8.2	5.435	25.4	44.57
			Tails	20,845.4	91.8	1.423	74.6	130.63
7	681	7	Head	22,700.0	100.0	2.52	100.0	251.89
			Conc	1,895.1	8.3	7.423	24.5	61.61
			Tails	20,804.9	91.7	2.075	75.5	190.28
8	454	8	Head	22,700.0	100.0	1.45	100.0	145.13
			Conc	1,742.4	7.7	5.482	29.1	42.21
			Tails	20,957.6	92.3	1.115	70.9	102.92
3	454	10	Head	22,700.0	100.0	1.58	100.0	157.87
			Conc	1,757.8	7.7	5.495	26.8	42.31
			Tails	20,942.2	92.3	1.252	73.2	115.56
2	454	15	Head	22,700.0	100.0	1.35	100.0	134.95
			Conc	1,092.3	4.8	7.308	26.0	35.08
			Tails	21,607.7	95.2	1.049	74.0	99.87
1	454	18	Head	22,700.0	100.0	1.57	100.0	157.38
			Conc	755.7	3.3	9.508	19.9	31.38
			Tails	21,044.3	96.7	1.303	80.1	126.00

b) Test to improve gold recovery

In this series of tests the ore sample was first passed through the cone at 5 PSI backpressure as in Test #5. A concentrate Conc.1 and a tailing, Tails-1 were obtained. The concentrate was saved and the Tails-1 was again processed at 5 PSI backpressure. A concentrate Conc-2 and a tailing, Tails-2 were obtained. Finally the Tails-2 was retreated at the same backpressure and Conc-3 and Tails-3 were produced.

Conditions

Feed rate (solids) lst pass	:	approx 500 kg/h
Water to the feed lst pass	:	approx.32 l/min
Slurry feed density "	:	approx 20% solids
Backpressure water rate	:	" 70 l/min
Water Pressure	:	" 5 PSI
Number of Treatments	:	3

Results

The results of these tests are presented in Table 2.

TABLE 2.

Test No.	Feed Rate kg/h	Backpressure P.S.I.	No. of Pass	Product	Weight g	Weight %	Assay Au g/t	% Dist Au
9	500	5	3	Head	18,778.	100.	1.659	100
				Comb. Conc.	5,256	28.	3.193calc.	53.9
				Tails	13,522.	72.	1.063	46.1

2.2 Testwork on Blackham Material

A demonstration test was carried out at Blackham placer using a 12" Knelson Concentrator mobile unit to evaluate and examine the equipment performance in a commercial size application. The concentrate obtained in the field was upgraded in a 4" cone.

2.2.1. Feed Material

The feed material was obtained from the Blackham placer after screening out the coarse, +6 mm (¼") particles.

It was estimated that about 60% of the gravel material reported in the -6mm fraction.

Approximately 3 yd^3 of gravel was used for this testwork.

The assay of the feed material indicated a content of .054 g/t Au.

2.2.2. Equipment

A 12" Knelson Concentrator cone was used to process the placer material.

The concentrate was then upgraded in a 4" cone.

The equipment set-up for the commercial application unit is given in Fig.2. The 4" unit had a set-up similar to that showed in Fig.1.

The gravel material was screened and washed in a trommel with 6 mm (¼") openings and the undersize was fed to the 12" cone. The tailing was continuously removed while the concen-

trate was trapped in the ribs and flushed out at the end of the run.

The technical characteristics of the Knelson Cone unit used for this test are:

12 inch Knelson Cone

Trommel:

Dimensions:		20" diameter x 8' long with 3 ft. screen section
Openings	:	6mm (¼ inch)
Motor	:	1 H.P. electric

Cone:

Weight	:	225 lbs
Dimensions:		3'x3'x2.5"
Motor	:	1 H.P. 600 R.P.M.

4 inch Knelson Cone

Cone:

Weight:	60 lbs
Dimensions:	18" x 18" x 24"
Motor:	¼ H.P. electric 1000 R.P.M.

2.2.3. Testwork Conditions and Results

Conditions

12 inch Cone

Feed rate (solids) to the trommel: approx.3t/h
Feed rate (solids) to the cone: approx.1.8t/h
Slurry feed density: estim.20% solids
Backpressure water: 15 PSI

4 Inch Cone

Feed rate (solids): approx.200 kg/h
Slurry feed density: estim.20% solids
Backpressure: 15 PSI

Results

The results of these tests are given in Table 3.

TABLE 3. Results of 12" and 4" Cones Concentration

Cone Size	Product	kg	Weight % Ind.	Weight % O/A	Assay Au g/t	% Distribut. Ind.	% Distribut. O/A
	Head	2700.30	100.	100.	.054	100	100.
12"	Rougher Conc.	5.961	.2	.2	4.716	17.5	17.5
	Rougher Tails	2694.039	99.8	99.8	.045(calc.(	82.5	82.5
	Rougher Conc.	5.961	100.	.20	4.716	100.	17.5
4"	Cleaner Conc.	0.605	10.1	.02	45.929	98.4	17.2
	Cleaner Tails	5.356	89.9	.18	0.086	1.6	0.3

3. TECHNICAL DISCUSSION

The Knelson Concentrator is a cone shaped device with rings spaced equa distant apart. In the 7.5" unit this is 1". Two rows of holes are in the recess of the rings. These holes are graduated to the diameter of the ring, there being more holes in the top ring than the bottom. This mechanism is encased in a water jacket and the whole assembly is mounted on a hollow vertical shaft. Water is injected through the shaft by means of a rotary joint and thus into the water jacket and then through the holes in the recesses of the rings. Material is fed into this unit by means of a screening device which slurries and sizes the material to -3/16. This is then fed into a pipe in the lid which delivers the material to the level of the bottom ring in the concentrator. The first material in fills the rings to capacity and this material is kept totally fluidized by the water coming in through the holes in the rings from the water jacket. At this point all new material entering the concentrator is passed over the material already contained in the rings; any particle in this new gangue that is heavier than particles existing in the rings, will report into the rings and displace a lighter particle of the fluidized bed. All particles are subjected to 60 forces of gravity. Consequently, the specific gravity difference in particles subjected to this 60 G force creates a very wide difference in their comparable specific gravity weights.

Let us first restate a simple fact. Fire assays are at

best an educated guess and do by no means give you a positive guarantee of Au. content in a sample. They are just and only a reasonable guide line. The writers simple conclusion here is that the large percentage of free gold did in fact report to the Concentrator and that the gold which did not report is not free gold and as such is not available to concentration by any gravity device. Let us first determine the term free gold. In discussion with Mr. Gordon Bacon, P.Eng., of Bacon Donaldson & Assoc., I am informed that any gold that is A) totally liberated (not attached in any way to any other material) and B) exposed on the surface of any particle and consequently available to a chemical type of recovery i.e. mercury, aquaregia, cyanide etc. is considered to be free gold. That conclusion, in the writers humble opinion, is false and misleading as the term "free" should not include gold that is not covered in A) above. My understanding of the word "free" is anything, article or creature that is totally removed from encumberance by any other thing, article or creature, and in the case of gold, unless it is free in this complete sense, then the rate or percent of recovery will decrease in direct proportion to the rate at which the material description departs from this true free gold form. The ore from which these tests were taken is a milled ore tailing which was evaluated in CANMET Labs to have a value of 1.7 g/t Au. Eight consequent tests by Bacon Donaldson showed 1.65 g/t Au.average. An examination of the facts

in Table 1 is, in the writers opinion telling us that A) The Knelson Concentrator is in fact collecting free gold but B) this is not sufficient to make these tailings a viable mining operation.

The writer will at this point attempt to describe what took place in each of the eight tests in Table 1.

Test #1 - Back Pressure 18 lbs. Conc. Wt. 755.7G: over-fluidization blowing out much of the light gangue and attaining the highest value per ton Au. The writer believes the finest of the free gold was also blown out at this pressure.

Test #2 - B.P. 15 lbs, Conc.Wt. 1092.3G: overfluidization-not blowing out as much light gangue but still blowing out some of the fine free gold.

Test #3 - B.P. 10 lbs. Conc. Wt. 1757.8G: Knelson Concentrator is now approaching maximum Retention of volume of material. Still blowing out some fine free gold but retaining a larger percentage of Au.

Test #8 - B.P. 8 lbs. Conc.Wt. 1742.4G: Concentrate weight decreases slightly from test #3 but percent Au. distribution increases following steady pattern from Test #1.

Test #7 - B.P.7 lbs. Conc.Wt.1895.: It should be noted here that tests using B.P. of 7,6,5lbs produce a concentrate weight so similar as to be near indistinguishable and the inconsistency of recovery pattern can probably be attributed to the vagaries of fire assay inconsistencies. The writer also believes that free gold is reporting quite consistently in these assays.

Test #4 - B.P.6 lbs. Conc.Wt.1854.6: The writer believes that only the very finest of free gold is being lost.

Test #5 - B.P. 5 lbs., Conc.Wt.1888.8: This appears to be the optimum and the writer believes if you could determine a true free gold content, that the recovery would be plus 85%.

Test #6 - B.P. 4 lbs. Conc.Wt.1766.9: Suddenly the trend reverses and you find that the concentrate weight decreases. The explanation for this is that true concentration is no longer taking place. Free gold in a percentage very close to Test #5 is being retained. However, the writer believes that if the concentrator were to continue running for an extended period, this percentage of recovery would decrease as what this decreased weight is telling you is that the material is packing and that the retained material in the rings is not moving; therefore, concentration is not taking place and this retained material is simply packed gangue and has an overall specific gravity very little different than that of the head feed.

One must understand that as soon as the backpressure water is reduced to the point that light gangue is not blown out, the concentrator then produces virtually the same volume of cons each time it is cleaned up but this volume will weigh more depending on A) exchange of heavy for light particles and B) the length of time the volume of material is put through the unit.

Effects of Grinding on Gold - one must understand that gold that will readily liberate in grinding is usually in cleav-

ages in the host material. This gold is easily concentrated if it is removed from the grinding circuit immediately. However, if it stays in the circuit it will be smeared onto all the accompanying particles. In this case, it is now affected by the total specific gravity of that particle it is attached to and is no longer free and no longer available to gravity separation.

The second factor is gold in sulphide or sulphate form which is virtually under the same laws as that described in the last sentence of the previous paragraph. For this reason, the writer believes that a concentrator such as the new Knelson Continuous Concentrator which will accept everything with an S.G. of 3.5 or greater and does not fill up a residual capacity but continuously produces and delivers a heavy concentrate will be able to offer to the mining industry a concentrator to draw off most all of the sulphides etc. into a concentrate and discard the non-bearing gangue immediately, thereby not wasting time, effort or money on worthless materials.

Let us now look at Test #9. In this instance, we have lumped several factors together but the following observation is valid. Three passes were made on the same material. The first pass was markedly higher than the succeeding two, and these were in fact quite similar. The explanation is as follows. Free gold was caught in the first pass; each succeeding pass was simply a concentration of heavy sulphide to the point of capacity of the concentrator. The result is very similar values in the last two batches of concentrates.

Now, we shall look at the performance on the Blackham gravels and start by noting the following points:

1. The values are so low as to be near non-existent.

2. This is a round river rock type of gangue that has travelled many many miles.

3. The rolling action of this rock and sand gangue is not too unlike the action in a ball mill.

4. The gold is pounded, flattened and has an aspec ratio in the range from 10-1 to 50-1.

5. The writer has had extensive experience with this type of material and feels comfortable with the following observation. This gold has been pounded, flattended, smeared and generally crushed by the moving action of the Fraser River to the extent that fully 80% of this gold is smeared on the overall gangue and that any larger particles have long since dropped out somewhere upstream.

Consequently, the recovery in one pass of only 20% of the gold is telling us again that the Knelson Concentrator is picking up the free gold and missing only that which is not available to gravity separation. The writer wishes to emphasize at this point that this smear effect is not only on the heavy black sand but is throughout the gangue and therefore, a second pass on this material will not produce an enhanced concentrate unless there is gold trapped in the black sand particles which is practically never the case.

To further verify this contention, a study of Table 3 brings out these points that the rougher concentrate produced by the 12" Knelson Concentrator showed a recovery of only 17.5% but when this was reprocessed through the 4" unit, the recovery shoots up to 98.4% of the gold reporting in this small amount (.605kg) of concentrate - a loss of only 1.6%. This is very easily explained. The 12" recovered the available free gold and the 4", true to form, took virtually all that free gold into its possession immediately in one pass. This performance falls in line with any test conducted on the Knelson Concentrator where a known amount of free gold was salted into the feed.

4. CONCLUSIONS

It is the opinion of the writer that the Knelson Concentrator did in fact retrieve the free gold and some of the heavy sulphides in the Forest Hills tailings but that this is not sufficient to warrant a commercial recovery by batch method and that continuous recovery by this method should be investigated.

The Knelson Concentrator did also recover virtually all of the free gold in the Blackham gravels but that the overall grade is far too low for commercial production.

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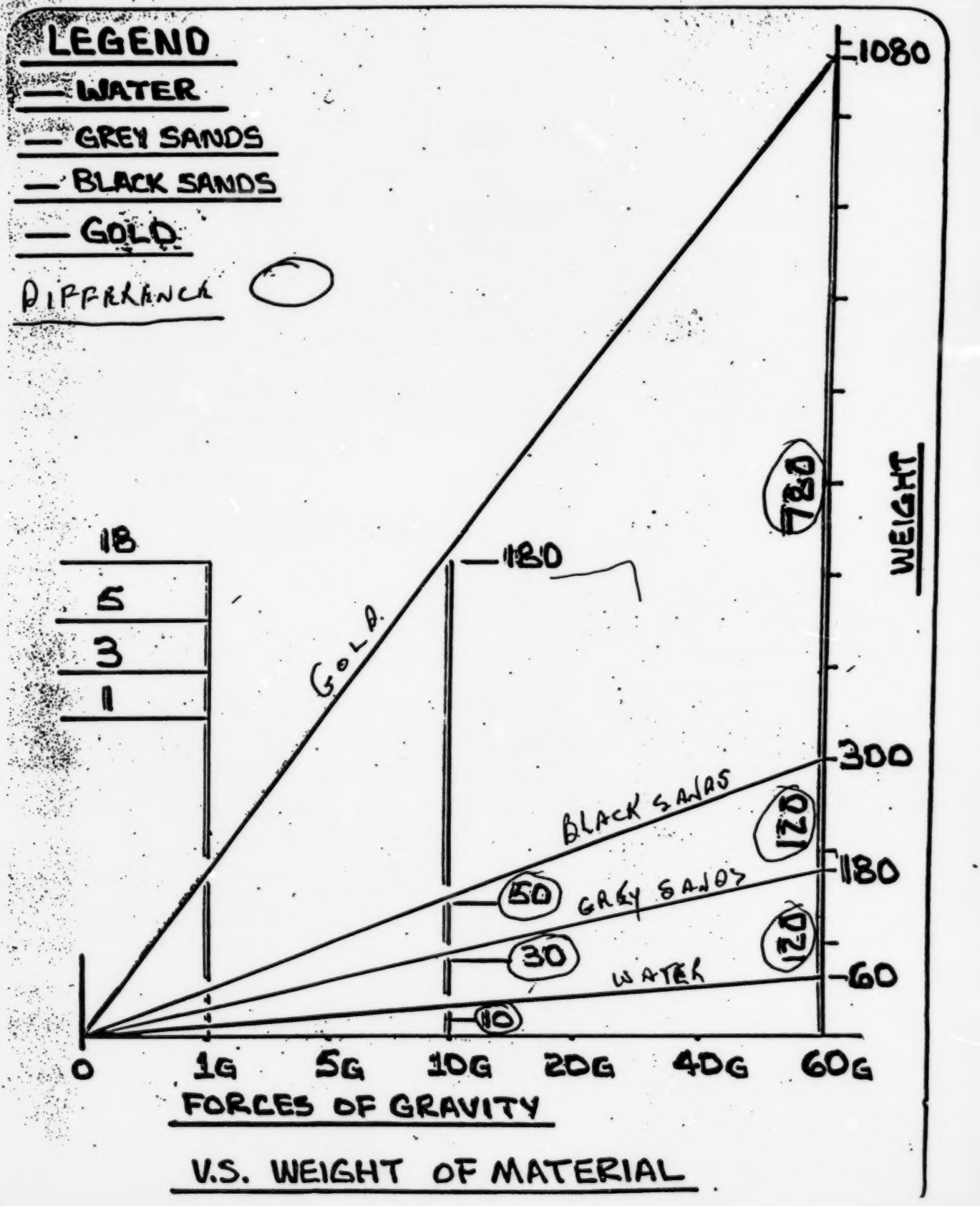
NO:991 AV



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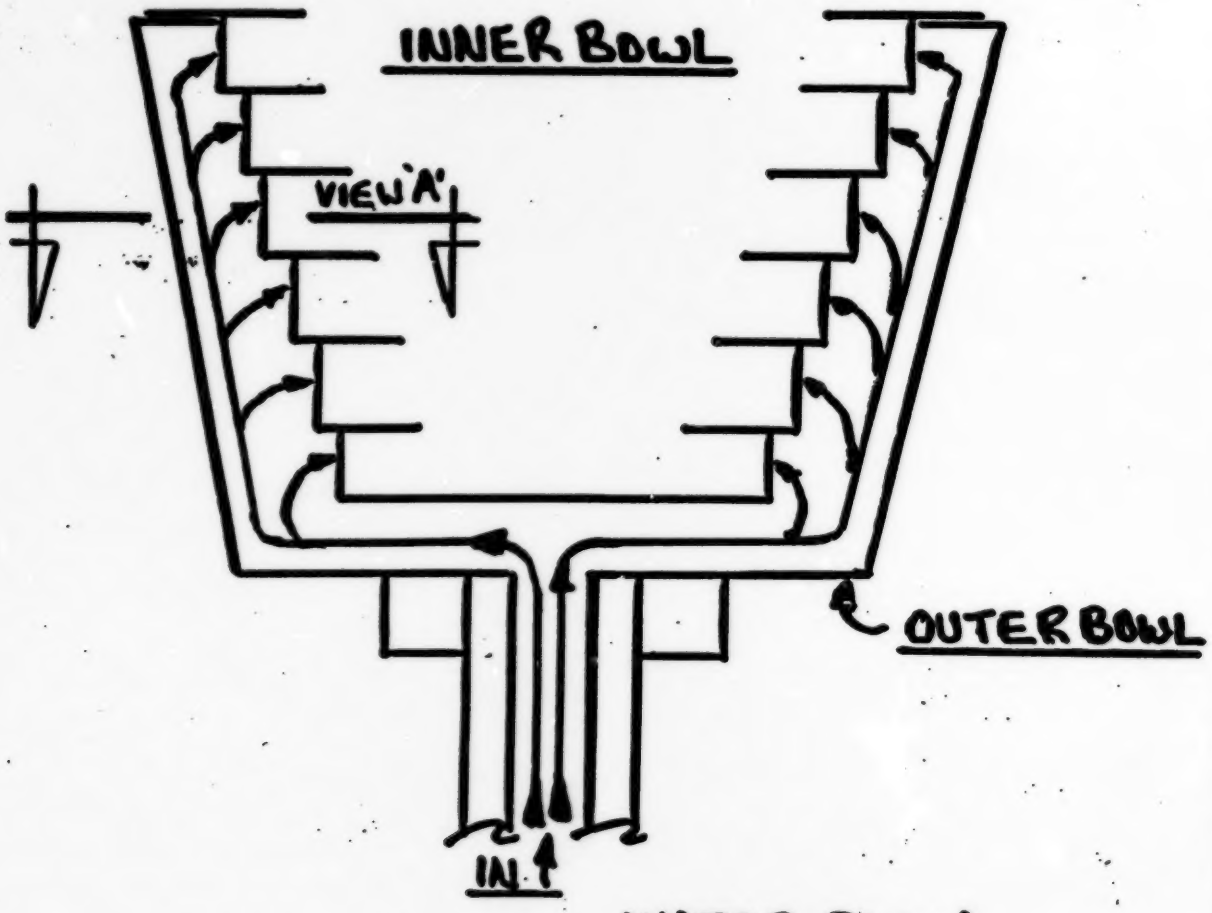
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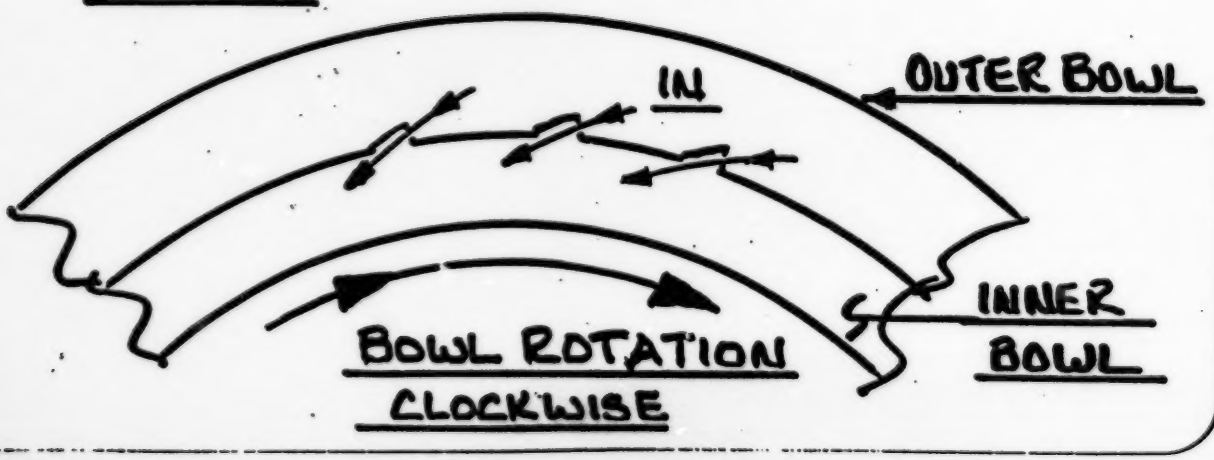
IN
OUTER BOWL
INNER BOWL
BOWL ROTATION CLOCKWISE

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CERTIFICATE OF ASSAY

Client:

LEE-MAR INDUSTRIES
20313 - 86th Avenue
R.R. 11
Langley, B.C. V3A 6Y3 Att: Byron Nelson

File No.: 5676
Date: March 8, 1985
P.O. No.:

We hereby certify that the following are the results of assays on: Samples submitted by Marius A. Cristovici.

SAMPLE IDENTIFICATION	Gold Content g/tonne	Average Gold Content g/tonne	Dry Weight g Sample Received
BLACKHAM, GRAVER AT			
Blackham Head	.031	.054	4129.8
" "	.051		
" "	.064		
" "	.068		
Blackham, Cleaner Conc	55.690	45.929	605.1
" "	36.167		
Blackham, Cleaner Tail	.047	.327	5355.7
" "	.162		
" "	.048		
" "	1.049		
Blackham, Rougher Tails	.748	.614	518.8
" "	.479		

PROVINCIAL ASSAYER

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SAMPLE IDENTIFICATION		Gold Content g/tonne	Average Gold Content g/tonne		Dry Weight g Sample Received			
Tail Test #7		2.160	2.075		-			
" "		1.989						
Tail Test #8		1.166	1.115		-			
" "		1.063						
Conc Test #1		10.457	9.508		755.7			
" "		8.558						
Conc Test #2		9.403	7.308		1092.3			
" "		5.212						
Conc Test #3		6.194	5.494		1757.8			
" "		4.796						
Conc Test #4		6.230	5.435		1854.6			
" "		4.639						
Conc Test #5		5.861	5.631		1888.8			
" "		5.401						

R. A. Williams
PROVINCIAL ASSAYER
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File No.: 5676
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P.O. No.:

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SAMPLE IDENTIFICATION		Gold Content g/tonne	Average Gold Content g/tonne		Dry weight g Sample received			
Canmet, Forest Hill								
Head		1.751	1.659		-7617.5			
"		1.566						
Tail Test #1		1.440	1.303		-			
" "		1.166						
Tail Test #2		1.097	1.049		-			
" "		1.000						
Tail Test #3		1.337	1.252		-			
" "		1.166						
Tail Test #4		1.920	1.423		-			
" "		.926						
Tail Test #5		1.063	.995		-			
" "		.926						
Tail Test #6		1.337	1.183		-			
" "		1.029						

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CERTIFICATE OF ASSAY

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Att: Byron Nelson

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Date: March 8, 1985
P.O. No.:

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SAMPLE IDENTIFICATION		Gold Content g/tonne	Average Gold Content g/tonne		Dry Weight Sample Received			
Conc Test #6		5.413	6.121		1766.9			
" "		6.829						
Conc Test #7		8.983	7.423		1895.1			
" "		5.863						
Conc Test #8		7.804	5.482		1742.4			
" "		3.160						
Test #9 Conc #1		416.181	442.732		1795.8			
" "		469.282						
Test #9 Conc #2		11.943	10.280		1648.9			
" "		8.616						
Test #9 Conc #3		19.578	24.489		1691.4			
" "		29.399						
Test #9 Tails		.683	.702		15159.9			
" "		.721						

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Bacon, Donaldson & Assoc. Ltd

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March 26, 1985

LEE-MAR INDUSTRIES LTD.
20313 - 86 Avenue
Langley, B.C.

Attention: Mr. B. Knelson

Dear Byron,

We have analyzed the samples you delivered as you have instructed. The results are:

Sample	Weight Assayed g.	Weight of Gold mg.	Dry Weight of Sample g.	Gold Assay Average g/tonne
Tail	30.75	.033	13,522	-1.063
	31.02	.032		
C1	20.02	1.582	1,823	-39.909
	37.52	1.513		
C2	35.02	.371	1,678	- 9.875
	36.10	.331		
C3	38.40	.208	1,755	- 4.732
	38.66	.157		

Yours truly,

BACON, DONALDSON & ASSOCIATES LTD.

W.G. Bacon

Dr. W. G. Bacon, P.Eng.

PLEASE NOTE

The Addendum to the Technical Discussion and the back-up amalgam assays etc. were done by the Contractor at no extra cost to contract in the interest of adding verification to the validity of the tests. Two more sets of tests will be done also outside of the contract. These will be forwarded along with further technical discussion when completed.

ADDENDUM TO 3. TECHNICAL DISCUSSION

A sample of Forest Hills tailings was pulled from the stock pile. A head sample was taken and the balance was amalgamated with mercury. The resulting amalgam, the head sample and all of the tailings were delivered to Bacon Donaldson for evaluation.

Certainly one test such as this is not conclusive in itself, but some very interesting indications appear. The head sample was split by standard methods and then the final assay amount was split with a micro splitter and the samples brought to near identical weights. If you divide the second sample .086 by the first .004, the answer is 21.5. This would indicate to the writer that there was some free gold in the head sample and that a chunk of it (relatively speaking) got into the second sample. Now to the tails from which the free gold has been removed - again the same method is employed but this time we have two near identical assays.

Let us now look at the amaglam recovery. The writer asked Bacon Donaldson to calculate the percentage of gold recovered by amalgam in relation to the total gold content in the sample. The answer was 26.53%. If we now look at the first eight samples in Table 1, an average recovery was 23.75%. However, we know that samples 1,2,3 and 8 were definately too high in backpressure and if we discount those four and go to the remaining four, i.e. 4,5,6 and 7, we now get an average of 28.55.

The first thing that comes to mind is,"how can this machine recover more gold than the amalgam". The answer again is quite simple. The Knelson Concentrator has gathered most, if not all, of the free gold plus some of the heavy sulphides containing gold, where the mercury amalgam has only picked up the free gold and the gold which was exposed on the surface of particles.

This is more or less the reverse of what happens with gravels such as Blackhams. In this case, the gold is not encapsuled but is smeared on all the gangue and this gold will report to the mercury amalgam.

In conclusion, fire assay will recover gold in the sulphides and since some of these sulphides report to the Knelson Concentrator, it will give you a higher recovery than amalgamation but in river gravels, the gold is exposed and therefore will in large part report to amalgamation but only the totally liberated gold particles will report to the Knelson Concentrator.

BACON, DONALDSON & ASSOCIATES LTD.
Consulting Engineers

2036 Columbia St., Vancouver, B.C. V5Y 3E1 • Tel. 879-8461, Telex 04-53437

1985 March 2?

File No.: 5701

LEE MAR INDUSTRIES LTD.
20313-86 Avenue
Langley, B. C.

Attention: Mr. B. Knelson

Dear Byron,

Re: Sample Analysis

We have anlayzed the samples you delivered as you have instructed. The results, by fire assay, are:

Sample	Weight Assayed g.	Weight of Gold mg.	Dry Weight of Sample g.	Gold Assay g/tonne	Average g/tonne
Head	30.65	.004	1923.1	1.440	-2.126
	30.60	.086		2.811	
Tail	52.83	.085	14008.5	1.611	-1.577
	54.88	.083		1.509	
Amalgam	-	7.901			

We were asked to calculate the assay of the tail sample if the weight of gold in the amalgam were included in the tail sample. This calculated assay is:

$$\text{Tail Assay} = \frac{(.085 + .083)\,(14008.5)}{(52.83 + 54.88)} + 7.901 - \frac{(14008.5/29.166)}{}$$

= 0.062 oz/ton gold

= 2.126 g/tonne

Yours truly,

BACON, DONALDSON & ASSOCIATES LTD.

W. G. Bacon

Dr. W. G. Bacon, P.Eng.
WGB:jd

BACKPRESSURE WATER

PSI	L/MIN	SEC/1589.6 CU.In.
4	59.9	26.1
5	70.4	22.2
6	77.4	20.2
7	84.9	18.4
8	90.3	17.3
9	97.7	16.0
10	100.2	15.6
15	129.2	12.1
18	143.4	10.9

FEED WATER (SLURRY)

Max	31.5	49.6
Min	15.5	101.0 (1'41")

Investigation of the Adaptability of the Knelson Concentrator to ore beneficiation.

CORRECTION

This is a correction to the final paragraph of Test #6 on Page 17 of the original report. Please delete and read as follows:

One must understand that as soon as the back pressure water is reduced to the point that free fluidization of the particles contained in the rings does not take place, then lighter gangue particles are not displaced by heavier ones and all concentration stops; in essence you now have a Knudson or Ainsley Bowl.

As is adequately displayed in table 1, high back-pressure blows out much of the concentrates in the rings and results in a smaller volume of cons. The right back pressure will produce a constant volume of cons each time you clean up but it will weigh more depending on A/ the volume of heavy material contained in the gangue and B/ the length of time it is run (the amount of concentrating done), and finally, too low a pressure will give you virtually the same volume of cons as the right back pressure but it will weigh essentially the same as the head feed because the first material in will immediately pack and no concentration i.e. displacement of light gangue for heavier concentrates, will take place.

All too often people will ask if we clean up when the rings are full. Please understand that the rings are always full from the first feed that enters, but too much pressure blows out values. The right pressure causes trading by specific gravity to take place and too little pressure causes packing.

ADDENDUM #2 TO 3. TECHNICAL DISCUSSION

This addendum will discuss the last two groups, which are also the final assays to be done for Canmet on the Forest Hills tailings.

In the Bacon Donaldson report dated April 16,1985, marked File #5734 - we started with 100 lbs of tailings, which is our head feed which assays at 1.440. In each of the eight samples two evaluations are made. The spread in the head feed is .184 and then in line with the writers assumptions in addendum #1, re file #5701, the first con comes out with a spread of 2.714 (this meets the writers conviction that the free gold is largely in the first concentrate). This will explain the wide spread by assuming that a larger piece (relatively speaking) of free gold got into the second sample. After this first con as with all fire assays there are still some wild swings but nothing close to the #1 concentration. The spread in the remaining cons are as follows: #2-.07, #3 - .386, #4 - .084, #5 - .437, #6 - .028, Tails .085.

Now to an examination based simply on gold in grams per ton - Conc. #1 is 9.510, then each successive concentrate is sharply declining but the large spread is between Con #1 & #2. The writer again contends that the free gold is coming out in the first concentrate and locked up values are being caught in heavy particle concentration (sulfides) in the succeeding tests.

We will now preceed to Assay certificate dated April 26, File #5748. In this instance, the material was intermittently

(5555.2 grams) which means we still have a loss of 14,895.9 grams or 33.25 lbs. The rest of the loss must be accounted for by the fact that we did not use a submersion tube with this series of tests and so our tailings barrel was continuously overflowing and losing material; faster than in previous tests.

Several pertinent assumptions can be made from studying these various tests in their entirety.

No.1 - By grinding to -100 mesh, you can increase the recovery, i.e. sample 5 on Page 8 is 80% the weight of feed sample in #5748 but is only 40% of the assay value per ton in the concentrate.

No.2 - If grinding everything to -100 gives us this kind of increase in recovery, then obviously the Knelson Concentrator is quite capable of recovering gold well below the 100 mesh size.

No.3 - Much of this gold is free milling if you grind fine enough.

No.4 - Unless you can retain every bit of the water and decant without losing any of the gangue, then trying to ascertain losses by assay of the tails is a useless exercise as when you lose gangue out of a tailings holding vessel, it will be subject to hindered settling principles (like an illeutriator) and will flow off particles that are generally the lightest thereby leaving the heaviest (read heaviest to mean holding most remaining values) to be assayed, and, in fact, you have created a concentrate, and the more of the gangue that washes away,

in a mill circuit, since this type of unit will use all of the concentrating factors of the present unit but will be continuous instead of batch.

E. Any performance of the Knelson Concentrator on a given ore must be run with close attention paid to the back pressure.

F. On this particular ore a back pressure of 5,6,or 7 lbs will definately produce the best results.

G. On ore with a high sulfide content a batch machine with a small residual capacity will not hold sufficient concentrates to make it usable unless it is cleaned up very frequently.

H. Because of the loss of gangue in the tailings containment overflow and the resultant concentration or upgrading of the remaining tailings, we have not as yet proven an accurate percentage of recovery by the Knelson Concentrator. All we do know is that it is, in fact, higher than we at first conceded in Table #1.

I. It will be virtually impossible to assess the ability of the Knelson Concentrator to recover gold from this type of ore with any degree of accuracy unless we know with absolute certainty the particle size and distribution and the positive amount of free (as in absolutely free) gold contained in the sample.

J. It is the writers contention that the Knelson Concentrator is less affected by particulate shape, size or

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CERTIFICATE OF ASSAY

Client:
LEE - MAR
20313 - 86th Avenue
R.R. 11
Langley, B.C.
V3A 6Y3

File No.: 5734
Date: April 16, 1985
P.O. No.:

We hereby certify that the following are the results of assays on:

SAMPLE IDENTIFICATION	Gold grams per tonne	gold grams per tonne average	net dry weight received grams
Head	1.348 1.532	1.440	1,747.8
Conc #1	8.153 10.867	9.510	1,618.2
Conc #2	3.421 3.351	3.386	1,513.7
Conc #3	1.947 2.333	2.140	1,625.3
Conc #4	1.181 1.265	1.223	1,646.3
Conc #5	.802 1.239	1.021	1,578.6
Conc #6	.968 .996	.982	1,677.6
Tail	.573 .488	.531	19,377.6

R. A. Williams
PROVINCIAL ASSAYER

BACON DONALDSON
& ASSOCIATES LTD.
CONSULTING ENGINEERS

2036 COLUMBIA STREET
VANCOUVER, B.C. V5Y 3E1
TEL. (604) 879-8461 • TELEX 04-53437

CERTIFICATE OF ASSAY

Client:

LEE-MAR
20313 - 86th Avenue
R.R. 11
Langley, B.C. V3A 6Y3

File No.: 5748
Date: 1985 April 26
P.O. No.:

We hereby certify that the following are the results of assays on:

SAMPLE IDENTIFICATION		Au g/tonne		Au Average g/tonne		Net Dry. Wt. Received g		
Conc. #1		-13.019 -14.887		-13.953		-1541.9		
Conc. #2		- 2.180 - 1.858		- 2.019		-1408.1		
Conc. #3		- .945 - .777		- .861		-1373.1		
Conc. #4		- .815 - 1.313		- 1.064		-1366.8		
Tail		- .416 - .392		.404		-1635.0		

R. Wilson

PROVINCIAL ASSAY

Bacon, Donaldson & Assoc. Lt